FRESHWATER HYDROIDS

The now familiar Hydra seems to have been first noticed in the year 1703. About 40 years later the observations or experiments of Abraham Trembly of Geneva excited a widely extended interest in it, not so much because of the peculiarities of its life history, as from its apparent indifference to the many seemingly fatal wounds given it to produce its death. On account of the interest taken in these experiments, this creature was often referred to as the Zoophyte of Trembly, but this had long since lapsed into the common, as well as generic, name of Hydra. Three species are generally recognized in this genus, as *Hydra vulgaris, Hydra viridis,* and *Hydra fusca,* on account of a variation in the number of their tentacles, a difference in their color, or an increase in their extensibility and consequent contractility. This is most conspicuous in the case of *Hydra fusca,* where we may first see it after disturbance as a "ball of greenish jelly," lengthening a moment later into a slender thread or stem, from near the distal, or outer, end of which six or more tentacles are budded out rapidly, lengthening into a drooping mass or fringe of extremely delicate filaments knotted along their whole length with what are known as lasso, or poison, cells. The water-flea or other Protozoan which accidentally touches one or more of these, is liable to be paralyzed by some of these poisonous darts, when the fortunate tentacle shrinks down to the mouth of the Hydra, quickly opened to receive it, and—*"facilis decensus averni."* So much for the common Hydra, which will easily be recognized.

The next Hydroid to join the list of freshwater forms was *Cordylophora lacustris,* much more complicated in its structure, wherein it nearly resembles several of the marine forms, and, while it does not throw off any free-swimming medusæ, it does, at certain seasons of the year, give birth to so-called *hydranths* that take root and grow up directly into a new generation of hydroids.

Following this come the Medusae, *Limnocodium sowerbii* and *Limnocnida tanganyikæ,* found respectively, the first in Regents Park Gardens in London in 1880, the other in 1883 in Lake Tanganyika, Central Africa. The parent hydroid of neither of these, or from which presumptively it must have arisen, has not,

as yet, been positively ascertained, although Mr. Bourne and others did find in other tanks and in the Kew Gardens, also in London, a hydroid greatly resembling the next to be described form, from which they assumed it may have descended. This connection the writer thinks has not, for reasons that will be given, been fully proved.

In the spring of 1885 the writer of the present paper, while studying the life history of a new Polyzoan, which he had named *Paludicella erecta,* found upon the surface of some stones collected during the previous autumn in the neighborhood of Philadelphia, Pa., and kept over winter in his home, some novel forms that he soon convinced himself were of hydroid character, though entirely destitute of tentacles, or of other organs of prehension or locomotion. These, with the consent of his friend, Dr. John A. Ryder, of the University of Pennsylvania, form the new genus *Microhydra ryderii.* They are about one-half a millimeter in length when single, or when branching near the base, which will be called the *pedal disc,* the total length is about one millimeter from head to head. The diameter of the cylindrical body is about one-tenth millimeter. A few lasso cells are scattered along it, but a great many, say 40 or 50, are collected upon each capitulum or head. Here the mouth is placed, but, except when the lips are everted while feeding, it is with difficulty recognized. As no means have yet been discovered by which it may remove or re-attach itself upon its pedal disc after removal, and having no grasping organs, our perplexity may be easily pardoned, when we strive to understand how this animal can catch others of better motive powers, and feed itself by killing them when caught. Many observations looking toward a determination of that point are narrated in a paper entitled "*Microhydra during* 1907" and published in the Proceedings of the Delaware Co. Institute of Science, Vol. III, No. 3, issued May 15, 1908. The space allotted me in the present publication will not allow of many of these, except to say that, lying as it were *perdue* upon the surface of these stones, under the protection of a crowded growth of Polyzoa and other localized animals, they are very likely to be crawled over by small annelids,

and many Protozoa still smaller, whom they can paralyze with their darts, and twist their mouths around so as to secure.

Although a stock of these interesting creatures was rarely, perhaps never, absent from the jars upon my study table, it will be noticed that it was not until 1897, or twelve years after their first discovery, that medusa buds were seen to be formed upon the hydroid stems, a millimeter in length, nor was an opportunity found until a lapse of ten years more for a more particular study, as will be presently described.

To supplement this, which is known as the sexual process of its development, nature, or, more properly its Author, has provided another, an a-sexual method of reproduction that deserves to be at least briefly described:

We may see quite frequently, but better when Microhydra is located upon the edge of a stone and stretches out so as to be brought into clear view by transmitted light, depressions at both ends of the *middle-third* of one side of its body. That, at the distal end, deepens more rapidly than the other, and, by a novel method of longitudinal fission, gradually approaches the other, the cellular structures of both parent and larva healing up and rounding out as the separation progresses. Finally the larva is nearly liberated and hangs by an invisible thread, until in our jars it is by any motion of the water wafted against the glass, where it temporarily adheres, an organism without organs, no capitulum, no pedal disc, no apparent mouth, no means of catching prey, or feeding upon it when caught. Plainly it is an inert, helpless body that we may safely call a larva, until we find, a week or ten days later, that a capitulum has been formed, a pedal disc prepared upon which it now stands upon the surface on which it may have been lying, and is now prepared to sustain life on its own account. I have watched this whole operation perhaps a score of times, and have found the process of segmentation to take about eight hours. I have said that during the larval period it is without organs of locomotion, yet we have been always ready to admit that it *does* move, probably by some amæboid action of its surface cells, that my eyes have not been quick enough to catch, even with the microscope.

It is recognized that any suggestions to students to collect and study this interesting group must be ineffective if they do not include information from my experience as to their favorite living places. Tacony Creek, although it furnished the first specimen, is not ideal, while Flat Rock Dam certainly is such. Most successful collectors of the plant-like fauna of our fresh waters early learn that these prefer to grow where rapid currents bring them a constant supply of food, and, at the same time, prevent silt from gathering over and smothering them. The factories along the Schuylkill Canal require much more water than is furnished by the infrequent opening of the canal gates to let boats through. For this reason a number of tunnels have been built to pass water from above the dam into the canal below the first set of gates, and at the point where they enter, at a depth of 6 or 8 feet, it becomes the really *"raging canawl"* of our derision. A dredging net of suitable length and strength is almost practically certain to bring up stones, large and small, covered with all varieties of the fauna I have already mentioned. These stones are placed in glass jars of from ½ to 2 gallons content, and, occupying places upon my table in a moderately warm room, rarely fail to supply me with a healthy stock for several months.

It is possible that the general students of zoology may be interested in a quotation from the paper referred to above, "Microhydra ryderii during 1907," describing the discovery of medusoid buds and their formation:

"It is possible that a few medusae were seen after their first discovery in 1897, say in 1898 or 1899, but no opportunity was found for such observation as was above suggested until May 16th of last year. On that morning a bud was doubtfully suspected, watched during that day and the next, and by 9 p. m. of the 17th the evidence of a coming medusa became convincing. Yet its position on the side of a jar, and in relation to the other members of the group, was not such as made possible the determination of the two points named above. The 'microscopical observatory' had not, at that date, been devised, and the best we could do was to stand the jar upon the side of which the budding medusa had been detected on a pile of books before a Welsbach gas light and examine it with

a Coddington lens or, later, through the tube removed from a compound microscope, and laid across another pile of books.

"This was the situation when, at 9.30 p. m., five of us determined not to lose sight of it during the night; wherefore one or more were continuously on the watch until 6.30 a. m. of May 18th. The first differentiation of parts had appeared about 9.30 p. m., May 17th, and all hands took part, though without artistic skill or scientific training in recording what we saw, by drawings, the most characteristic features of which I have here preserved. An examination of them will show the first recognizable feature to have been the *manubrium* at the proximal extremity of the bud—bearing upon its summit a circular or spherical form more or less complete in every figure, though variable in size; whose meaning must be left to elucidation through other specimens. Above or beyond this there was always a light-cavity of varying size and shape; and, almost from the beginning, transverse lines were to be seen at the distal end of the bud, suggestive of two membranes; and still more faintly longitudinal lines that ultimately resulted in becoming the *radial canals.* From 12.45 a. m. of May 18th and persistently thereafter, the innermost of the transverse lines mentioned gave convincing proof that it was to be the *velum,* including the marginal canal and circular aperture; and a few minutes later every observer noticed more or less distinctly, upon the outer membrane or surface, radial lines diverging from the apex or crown toward the position of the marginal canal, adjoining the velum. From 2.15 a. m. the approximately circular outline of the meduse changed to a pear shape, widening, with nearly straight lines, from the proximal to the distal end; and the faint lines of the radial canals became more marked. About 4.30 a. m. pulsation or throbbing of the velum was observed; at first a pair, *one, two;* then, say a half minute later, *one;* a pause, then, *one, two—one, two,* and so on, very irregularly; and thus continued, perhaps increasing in force until 5.30, when the *velum* with its aperture could easily be seen, distended, pressing up against and separating, at 6.20, the segmented tentacles as shown in two excellent drawings by Miss C. W. Beekley, as she saw them, parted, as when an orange is peeled

from any central point down to an equatorial line, and then forced upward by internal pressure.

"I know not what other observers may have written as to the formation of the earliest tentacles in marine medusa; but all our night watchers unhesitatingly agreed that my impressions of ten years ago had been proved correct, in relation to this species of freshwater forms. Of course, my theory assumes that the wider portions of these wedge-shaped segments contract, or, as it were, roll up upon themselves so as to form the nearly cylindrical tentacles as we know them. I place great weight upon the simultaneous appearance of the *whole eight,* without the slightest suggestion of longitudinal growth.

"The throbbings of the velum continued irregularly after the last drawing was made, finally liberating the medusa about 9 a. m. of the same day (May 18th). Two days had passed since the first determination of the bud, and the liberated medusa lived but two days longer, so that this specimen did not secure us any better sight of possible *sense organs* than had those seen ten years before."

EDWARD POTTS.

MUTATION IN MICRO-ORGANISMS

Dobell (Jour. Genetics, Nov. 1912 and Feb. 1913) gives a valuable review of the literature and a summary of the conclusions of investigators concerning mutation in micro-organisms.

In Trypanosomes (Nov., 1912,) it appears that definite structural changes may be produced by use of certain dyes, by cultivation in cold blooded vertebrates and certain invertebrates, which changes persist through subsequent divisions and apparently do not impair the power of division. In case of those treated with the dyes the kineto-nucleus is destroyed. The loss of this organ seems to decrease the virulence of the action of the Trypanosomes on the host. Virulence is changed also by the passage of the organism through the blood of certain animals. Resistance is developed by them also to certain drugs which are gradually administered. This increased resistance is transmitted in breeding.

In respect to the Bacteria, the author summarizes his digest in these words: "First it seems established that the Bacteria are